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Stationary and nonstationary affine combination of subdivision masks

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Abstract

One of the difficult task in subdivision is to create new effective subdivision schemes. Therefore, aim of this paper is a systematic analysis of affine combination of known subdivision masks to generate new subdivision schemes with enhanced properties. This will be done in the stationary and the non stationary case for the univariate and bivariate settings.

Keywords: Stationary subdivision schemes; Non stationary subdivision schemes; Symbols; Affine combination

1. Introduction

The power of subdivision schemes has been extensively established in several contexts, like, just to mention two well known examples, the design of smooth curves and surfaces and the generation of refinable functions and wavelets. Subdivision schemes basically are iterative schemes based on simple refinement rules generating increasingly dense sequences of points convergent to a continuous curve or surface. In the linear case, the refinement rules are simply average rules based on what is called the *mask* of the subdivision scheme. This is a finitely

supported sequence of coefficients. In the univariate case, a well-known example of subdivision scheme is given by B-spline subdivision schemes that can be used to generate spline curves.

Subdivision schemes range from stationary (i.e. the refinement rules do not depend on the recursion level) to nonstationary; from uniform (i.e. the refinement rules do not vary from point to point) to nonuniform; from binary (i.e. the number of points is 'doubled' at each iteration) to any a-rity; from scalar (i.e. the mask is made of real numbers) to vector (i.e. the mask is a sequence of matrices). For an exhaustive review of subdivision schemes we refer the reader to the survey paper [6]. Even though in recent years subdivision schemes have gained popularity and important steps have been made in their analysis, more non-trivial examples are still needed. This is particularly true in the multivariate setting. Therefore, the aim of this paper is to move a first step in the systematic analysis of affine combination of known subdivision masks to generate new subdivision schemes with enhanced properties. This will be done in the stationary and the non stationary case for the univariate and the bivariate settings.

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